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EXAMINER	
FUJITA, KATRINA R	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/521,254	KAUS ET AL.	
	Examiner	Art Unit	
	KATRINA FUJITA	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _01 September 2010_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-4,8-18 and 21-25_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-4,8-18 and 21-25_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This Office Action is responsive to Applicant's remarks received on September 01, 2010. Claims 1-4, 8-18 and newly added 21-25 remain pending.

Claim Rejections - 35 USC § 112

2. The previous 112 rejections have been withdrawn in light of Applicant's amendment.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 4, 15 and 21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 4 recites the limitation "a selected geometric primitive" in line 4. It is unclear whether Applicant intended this to be the same as or different from the "geometrical primitive" in line 7 of claim 2. The following will be assumed for examination purposes: -- ~~a~~ the selected geometric primitive --.

Claim 15 recites the limitation “labeling triangles” in line 7. It is unclear whether Applicant intends this to be the same as or different from the "triangles" in line 5 of claim 15. The following will be assumed for examination purposes: -- labeling <u>the</u> triangles --.

Claim 21 recites the limitation “fitting a geometric primitive” in line 7. It is unclear whether Applicant intends this to be the same as or different from the “geometric primitive” in line 11 of claim 15. The following will be assumed for examination purposes: -- fitting ~~a~~ <u>the</u> geometric primitive --.

Claim Rejections - 35 USC § 101

5. The previous 101 rejection has been withdrawn in light of Applicant’s amendment.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 1-4, 8-12, 14-16, 18, and 21-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Wu ("Computing parametric geon descriptions of 3d multi-part objects", Thesis), Weese et al. ("Shape Constrained Deformable Models...", Springer Article) and Holten-Lund et al. ("VRML Visualization...", ACM Article).

Regarding **claim 1**, Wu discloses a method for determining geometrical properties of a structure of an object of interest displayed in an image ("three-dimensional (3D) shape representation of objects based on parts" at page 1, last paragraph, line 1) comprising the steps of:

generating a deformable surface model of a surface of an object ("sphere is deformed towards the shape of the object and residuals between the model and data points are computed" at page 56, line 10; figure 4.9);

generating an extended deformable surface model of the object by associating additional geometrical information to the generated deformable surface model of the object ("parametric geon models are fitted to an object part" at page 61, line 8).

Wu does not disclose that the object is a training object and adapting the extended deformable surface model to a surface of the object of interest, such that a one-to-one point correspondence is maintained between the extended deformable surface model and the adapted extended deformable surface model.

Weese et al. teaches a method for determining geometrical properties of a structure of an object displayed in an image, comprising:

generating a deformable surface model of a surface of a training object ("build individual shape models" at section 3, line 2; "learning set" at section 3, line 4);

generating an extended deformable surface model of the training object by associating additional geometrical information to the generated deformable surface model of the training object ("external energy E_{ext} drives the mesh towards the surface patches obtained in the surface detection step. The internal energy E_{int} restricts the flexibility of the mesh" at section 2, line 6; "segmenting the vertebra and the femur, shape models were used" at section 2.5, line 2); and

adapting the extended deformable surface model to a surface of the object of interest, such that a one-to-one point correspondence is maintained between the extended deformable surface model and the adapted extended deformable surface model ("Mesh reconfiguration by minimization of the total energy of eq. (1) is done in two steps. First, the scaling s and orientation R of the shape model with the current weights of the eigenmodes are determined with respect to the current mesh configuration. This is done with a point-based registration method based on a singular value decomposition. Second, the vertex coordinates x_i and the weights p_k are updated using the scaling and orientation as determined in the first step" at section 2.4, line 1).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the correlation of a training set model to the model of the object of interest using the deformable segmentation of Weese et al. on the surface models of Wu to achieve improved robustness in segmentation of the data (see Weese et al. at section 4, last paragraph).

The Wu and Weese et al. does not explicitly disclose determining the geometric properties of the structure of the object of interest from the adapted extended deformable surface model according to the additional geometrical information and extracting at least one measurement of interest of the structure based on the determined geometrical properties.

Holten-Lund et al. teaches a method for determining geometrical properties of a structure of an object displayed in an image ("make the necessary measurements of the deformation" at section 1, paragraph 4, line 1), comprising:

determining the geometric properties of the structure of the object of interest ("measure the topology" at section 3, paragraph 2, line 5; figure 9, "Furthermore results of a measurement are shown" at window labeled "Angle-ent6") from the adapted extended deformable surface model ("iso-surface" at section 3, paragraph 2, line 1; the iso-surface models are also editable for simulation: "For editing isosurface models it is useful to be able to cut away parts of the model" at page 113, section 2.1.2, line 1) according to the additional geometrical information ("approximate primitives" at section 3, paragraph 2, line 4; figure 9, spherical primitive); and

extracting at least one measurement of interest of the structure based on the determined geometrical properties ("measure the topology" at section 3, paragraph 2, line 5; figure 9, "Furthermore results of a measurement are shown" at window labeled "Angle-ent6").

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the measurements of Holten-Lund et al. on the adapted models of the Wu and Weese et al. combination such that further understanding of object parts may be obtained by providing a quantification of the data, in addition to allowing the Wu and Weese et al. method to have a particular applicability to the field of medical imaging (see Holten-Lund et al. at section 1, paragraphs 3 and 4).

Regarding **claim 8**, Wu discloses an image processing device ("SPARC-10 or SGI R4000 or R8000 workstations" at page 81, line 7), comprising:

a memory (memory of workstation) which stores a model (figure 4.9) and an image depicting an end sub-part and a shaft sub-part (figure 6.25d); and

an image processor (processor of workstation) which determines geometrical properties of the sub-parts ("three-dimensional (3D) shape representation of objects based on parts" at page 1, last paragraph, line 1), wherein the processor is programmed to perform the following operation:

generating a deformable surface model of a surface of an object ("sphere is deformed towards the shape of the object and residuals between the model and data points are computed" at page 56, line 10; figure 4.9);

generating an extended deformable surface model of the object by associating additional geometrical information to the generated deformable surface model of the object ("parametric geon models are fitted to an object part" at page 61, line 8).

Wu does not disclose that the model is a simple training model, the sub-parts are of a bone, the training object being distinct from the bone depiction, and adapting the

extended deformable surface model to a surface of the object of interest, such that a one-to-one point correspondence is maintained between the extended deformable surface model and the adapted extended deformable surface model.

Weese et al. teaches an image processing device, comprising:

a memory (a memory associated with the Sun UltraSparc is implied) which stores a simple training model (“learning set” at section 3, line 4) and an image depicting an end sub-part and a shaft sub-part of a bone (figure 1, the two images in the middle column of the femur);

an image processor programmed to perform the following operations:

generating a deformable surface model of a surface of a training object, the training object being distinct from the bone depiction (“build individual shape models” at section 3, line 2; “learning set” at section 3, line 4);

generating an extended deformable surface model of the training object by associating additional geometrical information to the generated deformable surface model of the training object (“external energy E_{ext} drives the mesh towards the surface patches obtained in the surface detection step. The internal energy E_{int} restricts the flexibility of the mesh” at section 2, line 6; “segmenting the vertebra and the femur, shape models were used" at section 2.5, line 2); and

adapting the extended deformable surface model to a surface of the object of interest, such that a one-to-one point correspondence is maintained between the extended deformable surface model and the adapted extended deformable surface model (“Mesh reconfiguration by minimization of the total energy of eq. (1) is done in

two steps. First, the scaling s and orientation R of the shape model with the current weights of the eigenmodes are determined with respect to the current mesh configuration. This is done with a point-based registration method based on a singular value decomposition. Second, the vertex coordinates x_i and the weights p_k are updated using the scaling and orientation as determined in the first step" at section 2.4, line 1).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the correlation of a training set model to the model of the object of interest using the deformable segmentation of Weese et al. on the surface models of Wu to achieve improved robustness in segmentation of the data (see Weese et al. at section 4, last paragraph).

The Wu and Weese et al. does not explicitly disclose determining the geometric properties of the structure of the object of interest from the adapted extended deformable surface model according to the additional geometrical information and extracting at least one measurement of interest of the structure based on the determined geometrical properties.

Holten-Lund et al. teaches an image processing device, comprising:

an image processor (processor of PC, implied by section 3.2) for determining geometrical properties of the sub-parts of the bone ("make the necessary measurements of the deformation" at section 1, paragraph 4, line 1), which processor performs the following:

determining the geometric properties of the structure of the object of interest ("measure the topology" at section 3, paragraph 2, line 5; figure 9, "Furthermore results of a measurement are shown" at window labeled "Angle-ent6") from the adapted extended deformable surface model ("iso-surface" at section 3, paragraph 2, line 1; the iso-surface models are also editable for simulation: "For editing isosurface models it is useful to be able to cut away parts of the model" at page 113, section 2.1.2, line 1) according to the additional geometrical information ("approximate primitives" at section 3, paragraph 2, line 4; figure 9, spherical primitive); and

extracting at least one measurement of interest of the sub-parts based on the determined geometrical properties ("measure the topology" at section 3, paragraph 2, line 5; figure 9, "Furthermore results of a measurement are shown" at window labeled "Angle-ent6").

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the measurements of Holten-Lund et al. on the adapted models of the Wu and Weese et al. combination such that further understanding of object parts may be obtained by providing a quantification of the data, in addition to allowing the Wu and Weese et al. method to have a particular applicability to the field of medical imaging (see Holten-Lund et al. at section 1, paragraphs 3 and 4).

Regarding **claim 2**, the Wu, Weese et al. and Holten-Lund et al. combination discloses a method wherein the step of generating an extended deformable surface model further comprises the steps of:

identifying surface elements of the deformable surface model relating to a particular sub-part of the training object ("triangles belonging to the same physical part are obtained by a connected component labelling process" Wu at page 42, line 12; "surface patches associated with each of the detected surface points" Weese et al. at section 3, last sentence);

selecting a geometrical primitive having a form corresponding to a form of a particular sub-part ("approximate primitives" Holten-Lund et al. at section 3, paragraph 2, line 4; figure 9, spherical primitive); and

fitting the geometrical primitive to the surface elements relating to the particular sub-part of the training object in the deformable surface model ("All parametric geon models are fitted to an object part by minimising a function of the difference between the shape and size of a part and the models" Wu at page 61, line 9; figure 6.25).

Regarding **claim 3**, Wu discloses a method wherein the additional geometrical information is associated with each surface element of the extended deformable surface model ("parametric geon models are fitted to an object part" at page 61, line 8; figure 6.25).

Regarding **claim 4**, Wu discloses a method wherein the additional geometric information includes a sub-part identification, the selected geometric primitive, and a method for fitting the geometric primitive ("triangles belonging to the same physical part are obtained by a connected component labelling process" at page 42, line 12; figure 6.25).

Regarding **claim 9**, the Wu, Weese et al. and Holten-Lund et al. combination discloses a computer-readable medium having processor-executable instructions thereon ("All programs were written in C or C++ and were run on SPARC-10 or SGI R4000 or R8000 workstations" Wu at page 81, line 7) for execution by a processor of the image processing device above to control the processor to perform the method of claim 1 as described above.

Regarding **claim 10**, Wu discloses a method for determining geometric properties of a subpart of an object interest ("finite element model in the form of a closed triangular mesh is created over the object surface" at page 42, line 7), comprising:

with a processor (processor of "SPARC-10 or SGI R4000 or R8000 workstations" at page 81, line 7), generating a deformable model represented by a polygon mesh of a surface of an object ("sphere is deformed towards the shape of the object and residuals between the model and data points are computed" at page 56, line 10; figure 4.9);

with the processor, extending the generated deformable surface model with additional geometrical information ("parametric geon models are fitted to an object part" at page 61, line 8)

with the processor, deforming the extended deformable model to optimally fit a surface of at least one sub-part of the object of interest ("parametric geon models are fitted to an object part by minimising a function of the different between the shape and size of a part and the models; the best model for that part is selected" at page 61, line 8).

Wu does not disclose that the object is a training object.

Weese et al. teaches a method for determining geometrical properties of a structure of an object displayed in an image, comprising:

with a processor, generating a deformable surface model represented by a polygon mesh to a surface of a training object ("build individual shape models" at section 3, line 2; "learning set" at section 3, line 4);

with the processor, extending the generated deformable surface model with additional geometrical information ("external energy E_{ext} drives the mesh towards the surface patches obtained in the surface detection step. The internal energy E_{int} restricts the flexibility of the mesh" at section 2, line 6; "segmenting the vertebra and the femur, shape models were used" at section 2.5, line 2); and

with the processor, deforming the extended deformable model to optimally fit a surface of at least one sub-part of the object of interest ("Mesh reconfiguration by minimization of the total energy of eq. (1) is done in two steps. First, the scaling s and orientation R of the shape model with the current weights of the eigenmodes are determined with respect to the current mesh configuration. This is done with a point-based registration method based on a singular value decomposition. Second, the vertex coordinates x_i and the weights p_k are updated using the scaling and orientation as determined in the first step" at section 2.4, line 1).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the correlation of a training set model to the model of the object of interest using the deformable segmentation of Weese et al. on the surface models of

Wu to achieve improved robustness in segmentation of the data (see Weese et al. at section 4, last paragraph).

The Wu and Weese et al. does not explicitly disclose determining the geometric properties of the object of interest based on the additional geometrical information of the deformed extended surface model fit to the sub-part.

Holten-Lund et al. teaches a method for determining geometric properties of a subpart of an object ("make the necessary measurements of the deformation" at section 1, paragraph 4, line 1), comprising:

with the processor (processor of PC, implied by section 3.2), determining geometrical properties of the object of interest ("measure the topology" at section 3, paragraph 2, line 5; figure 9, "Furthermore results of a measurement are shown" at window labeled "Angle-ent6") based on the additional geometrical information of the deformed extended surface model fit to the sub-part ("iso-surface" at section 3, paragraph 2, line 1; the iso-surface models are also editable for simulation: "For editing isosurface models it is useful to be able to cut away parts of the model" at page 113, section 2.1.2, line 1).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize the measurements of Holten-Lund et al. on the adapted models of the Wu and Weese et al. combination such that further understanding of object parts may be obtained by providing a quantification of the data, in addition to allowing the Wu

and Weese et al. method to have a particular applicability to the field of medical imaging (see Holten-Lund et al. at section 1, paragraphs 3 and 4).

Regarding **claim 11**, the Wu, Weese et al. and Holten-Lund et al. combination discloses a method further including:

labeling elements of the polygon mesh corresponding to the at least one sub-part ("triangles belonging to the same physical part are obtained by a connected component labelling process" Wu at page 42, line 12);

selecting a geometrical primitive having a form corresponding to a form of a particular sub-part ("approximate primitives" Holten-Lund et al. at section 3, paragraph 2, line 4; figure 9, spherical primitive); and

fitting the geometric primitive to the labeled elements of the polygon mesh corresponding to each of the at least one sub-part of interest ("All parametric geon models are fitted to an object part" Wu at page 61, line 8; "best model for that part is selected" Wu at page 61, line 9).

Regarding **claim 12**, the Wu, Weese et al. and Holten-Lund et al. combination discloses a method wherein the deformable surface model is generated of at least a first and a second sub-part of the object and further including:

identifying elements of the polygon mesh fit to the first sub-part ("triangles belonging to the same physical part are obtained by a connected component labelling process" Wu at page 42, line 12 corresponding to the part defined by the cylinder in figure 6.25b);

identifying elements of the polygon mesh fit to the second sub-part ("triangles belonging to the same physical part are obtained by a connected component labelling process" Wu at page 42, line 12 corresponding to the part defined by the sphere in figure 6.25b);

fitting a first geometric primitive to the elements of the polygon mesh identified to the first sub-part ("All parametric geon models are fitted to an object part by minimising a function of the difference between the shape and size of a part and the models" Wu at page 61, line 9; cylinder in figure 6.25b);

fitting a second geometric primitive to the elements of the polygon mesh identified to the second sub-part ("All parametric geon models are fitted to an object part by minimising a function of the difference between the shape and size of a part and the models" Wu at page 61, line 9; sphere in figure 6.25b);

deforming the first and second primitives as part of the deformed extended surface model ("Mesh reconfiguration by minimization of the total energy of eq. (1) is done in two steps. First, the scaling s and orientation R of the shape model with the current weights of the eigenmodes are determined with respect to the current mesh configuration. This is done with a point-based registration method based on a singular value decomposition. Second, the vertex coordinates x_i and the weights p_k are updated using the scaling and orientation as determined in the first step" Weese et al. at section 2.4, line 1); and

determining the geometric properties of the object of interest using properties of the first and second deformed geometric primitives of the deformed extended surface

model ("measure the topology" Holten-Lund at section 3, paragraph 2, line 5; figure 9, "Furthermore results of a measurement are shown" at window labeled "Angle-ent6"; "iso-surface" at section 3, paragraph 2, line 1; as each part is labeled, each can be measured utilizing the method of Holten-Lund on each part).

Regarding **claim 14**, Wu discloses a method wherein the step of fitting the extended deformable surface model to optimally fit the surface of the at least one sub-part of the object of interest, further includes:

identifying a plurality of surface points of the surface of the sub-part of the object of interest ("triangles belonging to the same physical part are obtained by a connected component labelling process" at page 42, line 12); and

altering the polygon mesh to fit vertices of the polygons mesh to the identified surface points ("All parametric geon models are fitted to an object part by minimising a function of the difference between the shape and size of a part and the models" at page 61, line 9; figure 6.25).

Regarding **claim 15**, the Wu, Weese et al. and Holten-Lund combination discloses a method wherein the deformable surface model includes a mesh of triangles and the step (b) of generating an extended deformable surface model includes:

identifying triangles belonging to subparts of the training object ("triangles belonging to the same physical part are obtained by a connected component labelling process" Wu at page 42, line 12);

labeling triangles belonging to the respective subparts of the training object ("triangles belonging to the same physical part are obtained by a connected component labelling process" Wu at page 42, line 12);

selecting a geometric primitive in accordance with a measurement to be carried out and a form of a selected corresponding subpart ("measure the topology" Holten-Lund at section 3, paragraph 2, line 5; figure 9, "Furthermore results of a measurement are shown" at window labeled "Angle-ent6"; the sphere primitive is selected for measurements associated with the femoral head);

fitting the geometric primitive to the surface elements labeled to the selected corresponding subpart ("All parametric geon models are fitted to an object part by minimising a function of the difference between the shape and size of a part and the models" Wu at page 61, line 9; figure 6.25);

determining a rule which defines the selected geometric primitive and a method which fits the selected primitive onto the selected corresponding subpart ("these primitives are calculated from vertices and their respective normals on an iso-surface model of the bone surface" Holten-Lund at page 112, section 2, line 3; figure 2, "A plane approximated from vertices on the acetabular rim"; "Vertices and normals are sent to the Script node which calculates " approximating sphere and sends its center and radius to the wireframe model" at page 114, Figure 7); and

labeling each triangle with the determined rule along with the respective sub-part label to generate an extended deformable surface model ("triangles belonging to the

same physical part are obtained by a connected component labelling process" Wu at page 42, line 12).

Regarding **claim 18**, the Wu, Weese et al. and Holten-Lund combination discloses a method wherein each triangle having a normal and the step (c) of adapting the extended deformable surface model includes :

(d) for each triangle, searching along a triangle normal to find a point of intersection with surface of the object of interest ("For surface detection, a search is performed along the triangle normal ni to find the point ˜xi with the optimal combination of feature value Fi(˜xi) and distance δj to the triangle center ˆxi:" Weese et al. at section 2.1, line 1);

(e) formulating an energy function from the points of intersection and vertices of the triangle mesh (equation (1) Weese et al. at section 2, line 5);

(f) minimizing the energy function to define new coordinates for the vertices of the triangular mesh ("Mesh reconfiguration by minimization of the total energy of eq. (1)" Weese et al. at section 2.4, line 1);

(g) iteratively repeating the steps (d)-(f) of searching along a triangle normal, formulating an energy function, and minimizing the energy function to generate the adapted extended deformable surface model ("First, the scaling s and orientation R of the shape model with the current weights of the eigenmodes are determined with respect to the current mesh configuration. This is done with a point-based registration method based on a singular value decomposition. Second, the vertex coordinates xi

and the weights pk are updated using the scaling and orientation as determined in the first step" Weese et al. at section 2.4, line 2).

Regarding **claim 16**, the Wu, Weese et al. and Holten-Lund combination discloses a method wherein the object is a femur and the subparts include a femur head and a femur shaft (figure 9 of Holten-Lund shows that the object is a femur that includes a femur head and shaft; Weese et al. also shows that the object includes a femur head and shaft in the middle column of figure 1).

Regarding **claim 21**, the Wu, Weese et al. and Holten-Lund combination discloses a method wherein the structure of the object of interest corresponds to the selected corresponding sub-part and the step (d) of determining geometrical properties of the structure of the object of interest includes:

extracting the vertex coordinates of the triangular mesh of the selected corresponding sub-part ("The scale s and the orientation R of the shape model, as well as its weights pk, must be determined in addition to the vertex coordinates xi during mesh reconfiguration" Weese et al. at section 2.3, last sentence);

fitting a geometric primitive to the extracted coordinates according to the rule labeled to the respective triangles ("All parametric geon models are fitted to an object part by minimising a function of the difference between the shape and size of a part and the models" Wu at page 61, line 9; figure 6.25); and

estimating parameters which define at least one geometrical property of the fitted geometric primitive ("measure the topology" Holten-Lund at section 3, paragraph 2, line

5; figure 9, “Furthermore results of a measurement are shown” at window labeled “Angle-ent6”).

Regarding **claim 22**, Weese et al. discloses a method wherein the training object and the object of interest are distinct (“The test vertebra itself was excluded from the learning set, to avoid a bias” at section 3, line 4).

Regarding **claim 23**, Weese et al. discloses a method herein the one-to-one correspondence ensures that the position of a surface element and the number of surface elements are maintained after adaptation (“Since the shape model provides a suitable distribution of mesh vertices, the internal energy has been designed to maintain this distribution” at section 2.3, line 7).

Regarding **claim 24**, the Wu, Weese et al. and Holten-Lund combination discloses a device wherein the bone is a femur, the end sub-part is a femur head, and the shaft sub-part is a femur shaft (figure 9 of Holten-Lund shows that the object is a femur that includes a femur head and shaft; Weese et al. also shows that the object includes a femur head and shaft in the middle column of figure 1).

Regarding **claim 25**, the Wu, Weese et al. and Holten-Lund combination discloses an image processing device comprising:

a processor (processor of “SPARC-10 or SGI R4000 or R8000 workstations” Wu at page 81, line 7) programmed to perform the method of claim 1 as described above; and

a memory (memory of workstation) which stores the deformable surface model of the training object and an image depicting the object of interest (see claim 8 above.).

8. Claims 13 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Wu, Weese et al. and Holten-Lund as applied to claims 12 and 16 above, and further in view of Pelletier et al. (US 6,560,476).

Regarding **claim 13**, the Wu, Weese et al. and Holten-Lund combination discloses a method wherein the object is a bone (figure 9 of Holten-Lund; Weese et al. also shows that the object includes a femur head in the middle column of figure 1) the first and second sub-parts are an end and a shaft, respectively, of the bone (femur head in figure 9; Weese et al. also shows that the object includes a femur shaft in the middle column of figure 1) and the geometric property of the object of interest is at least one of a location, an orientation, and/or a center which are derived directly from the parameters of the first deformed primitives (figure 9 shows the orientation of the femur which is derived from the positioning of the sphere; figure 9 also shows different possibilities for measurements, e.g. distance, point).

The Wu and Holten-Lund combination does not disclose that the second geometric primitive is a line and the geometric property of the object is derived directly from parameters of the second primitive.

Pelletier et al. teaches a method in the same field of endeavor of 3D medical imaging visualization, wherein the object is a bone and the sub-part is a shaft of the bone, the geometric primitive is a line and the geometric property of the object is derived directly from parameters of the primitive ("Referring to FIG. 8, once the data set has been segmented, the system fits (step 50) a simple geometrical primitive to the 3D

active contour results from the bone-cartilage interface. The primitive is chosen to mimic the shape of the bone surface. A cylinder is used for the femur and planes are used for the tibia and patella" at col. 13, line 16; "Different structures within a joint can be quantified separately using the mask map" at col. 14, line 24; a cylinder is analogous to a line, as it is a line with a wider cross-sectional radius).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize a line as taught by Pelletier et al. to model the shaft of the Wu, Weese et al. and Holten-Lund combination to achieve the predictable results of representing the orientation and location of the bone shaft such that further diagnostic information can be gathered from its visualization.

Regarding **claim 17**, the Wu, Weese et al. and Holten-Lund combination discloses a method wherein the geometric primitive fit to the femur head includes a sphere (figure 9 of Holten-Lund; Weese et al. also shows that the object includes a femur head in the middle column of figure 1).

The Wu, Weese et al. and Holten-Lund combination does not disclose that the geometric primitive fit to the femur shaft includes a straight line.

Pelletier et al. teaches a method in the same field of endeavor of 3D medical imaging visualization, wherein the geometric primitive fit to the femur shaft includes a straight line ("Referring to FIG. 8, once the data set has been segmented, the system fits (step 50) a simple geometrical primitive to the 3D active contour results from the bone-cartilage interface. The primitive is chosen to mimic the shape of the bone

surface. A cylinder is used for the femur and planes are used for the tibia and patella" at col. 13, line 16).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to utilize a line as taught by Pelletier et al. to model the shaft of the Wu, Weese et al. and Holten-Lund combination to achieve the predictable results of representing the orientation and location of the bone shaft such that further diagnostic information can be gathered from its visualization.

Response to Arguments

9. Applicant's arguments with respect to claims 1-4, 8-18 and 21-25 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Lorenz et al. ("Generation of Point-Based 3D Statistical Shape...") is pertinent as disclosing background information with regard to the Weese et al. reference and is hereby enclosed for further understanding of the shape models generated in Weese et al.

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KATRINA FUJITA whose telephone number is (571)270-1574. The examiner can normally be reached on M-Th 8-5:30pm, F 8-4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Katrina Fujita/
Examiner, Art Unit 2624

/VIKKRAM BALI/
Supervisory Patent Examiner, Art Unit 2624